



## Training on Integrated Distribution System Planning for Midwest/MISO Region October 13-15, 2020

### Resources for More Information

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#### Distribution components, systems and operations

- ABB Inc., [\*Integrated SCADA/DMS/OMS: Increasing Distribution Operations Efficiency\*](#), 2009
- California Institute for Energy and Environment, [\*Distribution System Voltage Management and Optimization for Integration of Renewables and Electric Vehicles – Status and State of the Art\*](#)
- Argonne National Laboratory, [\*Foundational Report Series: Advanced Distribution Management Systems for Grid Modernization — DMS Integration of Distributed Energy Resources and Microgrids\*](#), 2017
- [EPRI video](#)

#### Integration, management and control of distributed energy resources (DERs)

- NREL, [\*IEEE 1547-2018 Resources\*](#)
- NREL, [\*An Overview of Distributed Energy Resource Interconnection: Current Practices and Emerging Solutions\*](#), 2019
- NARUC, [\*Adoption of IEEE 1547-2018 and Interconnection Procedures\*](#), 2020
- NREL, [\*High-Penetration PV Integration Handbook for Distribution Engineers\*](#), 2016
- NREL, [\*Sequential Mitigation Solutions to Enable Distributed PV Grid Integration\*](#)
- NREL, [\*New Approaches to Distributed PV Interconnection: Implementing Considerations for Addressing Emerging Issues\*](#)
- DOE, [\*Revised IEEE 1547-2018 Standard Will Aid Solar Integration\*](#), 2019
- NERC, [\*Reliability Guideline: Bulk Power System Reliability Perspectives on the Adoption of IEEE 1547-2018\*](#), 2020
- U.S. Department of Energy, [Grid-Interactive Efficient Buildings website](#)
- [Better Buildings Alliance Renewables Integration Team](#)

#### Transmission/distribution operational coordination

- P. De Martini et al., [\*Operational Coordination Across Bulk Power, Distribution and Customer Systems\*](#), 2019

- P. De Martini and L. Kristov, [\*Distribution Systems in a High Distributed Energy Resources Futures: Planning, Market Design, Operation and Oversight\*](#), Future Electric Utility Regulation Report # 2, 2015
- JD Taft, [\*Architectural Basis for Highly Distributed Transactive Power Grids: Frameworks, Networks, and Grid Codes\*](#), 2016

### Cybersecurity

- U.S. Department of Homeland Security's National Cybersecurity and Communications Integration Center and Industrial Control Systems Cyber Emergency Response Team, [\*Recommended Practice: Improving Industrial Control System Cybersecurity with Defense-in-Depth Strategies\*](#), 2016
- National Institute of Standards and Technology, [\*Framework for Improving Critical Infrastructure Cybersecurity\*](#), 2018

### Distribution system planning components

- U.S. Department of Energy's [\*Modern Distribution Grid\*](#) guides
- Alan Cooke, Juliet Homer and Lisa Schwartz, [\*Distribution System Planning – State Examples by Topic\*](#), Pacific Northwest National Laboratory and Lawrence Berkeley National Laboratory (Berkeley Lab), 2018
- Minnesota Public Utilities Commission integrated distribution system planning docket 15-556, available at eDockets:  
<https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showeDocketsSearch&showEdocket=true>
- Hawaiian Electric [\*Integrated Grid Planning website\*](#)

### Emerging distribution planning analyses

#### *Forecasting loads with DERs*

- Gagnon, P., G. Barbose, B. Stoll, A. Ehlen, J. Zuboy, T. Mai and A. Mills. 2018. [\*Estimating the Value of Improved Distributed Photovoltaic Adoption Forecasts for Utility Resource Planning\*](#). National Renewable Energy Laboratory and Berkeley Lab
- Mills, A.D., G.L. Barbose, J. Seel, C. Dong, T. Mai, B. Sigrin and J. Zuboy. 2016. [\*Planning for a Distributed Disruption: Innovative Practices for Incorporating Distributed Solar into Utility Planning\*](#). Berkeley Lab
- Cohen, M.A., P.A. Kauzmann and D.S. Callaway. 2016. "[\*Effects of Distributed PV Generation on California's Distribution System, Part 2: Economic Analysis\*](#)." *Solar Energy*, Special Issue: Progress in Solar Energy, 128(April): 139–152
- Darghouth, N.R., R.H. Wiser, G. Barbose and A.D. Mills. 2016. "[\*Net Metering and Market Feedback Loops: Exploring the Impact of Retail Rate Design on Distributed PV Deployment\*](#)." *Applied Energy* 162(January): 713–722
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- Electric Power Research Institute. 2015. [\*Distribution Feeder Hosting Capacity: What Matters When Planning for DER?\*](#)
- Mooney, M. 2018. "[\*Distributed Solar Generation in the Long-Term Load Forecast\*](#)." Presented at the Resources Adequacy Planning Department Intermittent Resources Subcommittee, PJM, December 10.
- Meade, N., and T. Islam. 2006. "[\*Modelling and Forecasting the Diffusion of Innovation – A 25- Year Review\*](#)." *International Journal of Forecasting* 22(3): 519–545
- Navigant Consulting, Inc. 2016. [\*Virginia Solar Pathways Project: Study 1 - Distributed Solar Generation Integration and Best Practices Review\*](#). Prepared for Dominion Virginia Power
- Pacific Gas & Electric. 2015. [\*Distribution Resources Plan\*](#)

### **Hosting capacity and interconnection**

- National Renewable Energy Laboratory, [Hosting Capacity for Policy Makers](#), 2019
- National Renewable Energy Laboratory, [Advanced Inverters \(1547\) capabilities, experiences, and interactions with hosting capacity](#), 2019
- Smarter Grid Solutions, [Enhanced Hosting Capacity Analysis](#), Prepared for Minnesota Department of Commerce, 2018
- California Distributed Resource Plan (R.14-08-013) Integration Capacity Analysis Working Group, [Final ICA WG Long Term Refinements Report](#)
- Interstate Renewable Energy Council, [Optimizing the Grid: Regulators Guide to Hosting Capacity Analyses for Distributed Energy Resources](#), 2017

### **Locational net benefits, non-wires analysis and DER sourcing**

- California Public Utilities Commission, [Decision adopting Distribution Investment Deferral Framework](#), Feb. 8, 2018
- Denholm, P. et al., National Renewable Energy Laboratory, [Methods for Analyzing the Benefits and Costs of Distributed Photovoltaic Generation to the U.S. Electric Utility System](#), 2014
- Faruqi, A. and C. Bourbonnais, "[The Tariffs of Tomorrow](#)," IEEE PES Magazine, May/June 2020, pp. 18-25
- Ngo et al., "Investing for the Future," IEEE PES Magazine, Jan/Feb 2020 p. 34-42. Available at <https://magazine.ieee-pes.org/back-issues/>
- Peak Load Management Alliance, "[APS and EnergyHub for APS Distributed Energy Resource Aggregations](#)," June 4, 2020
- SCE, [Distribution Deferral Opportunities Report/Grid Needs Assessment](#), 2020
- Seel, J. et al., [Impacts of High Variable Renewable Energy Futures on Electric-Sector Decision Making: Demand-Side Effects](#), Berkeley Lab, 2020
- Wood Mackenzie, [US non-wires alternatives H1 2020: Battery storage seizes top spot as utilities' preferred non-wires resource](#), 2020

### **Integrated distribution resilience planning**

- Michigan Public Service Commission, [Sept. 11, 2019, order](#) in Case No. U-20147
- Pacific Gas & Electric, [2020 Wildfire Mitigation Plan](#), Feb. 28, 2020
- Xcel Energy, [Integrated Distribution Plan: 2020-2029](#), Nov. 1, 2019
- Hawaiian Electric [Resilience Working Group](#)

### **Grid modernization planning and investment economics**

- U.S. Department of Energy's [Modern Distribution Grid](#) project
- Hawaiian Electric, [Modernizing Hawai'i's Grid For Our Customers](#), 2017
- Xcel Energy, [Integrated Distribution Plan: 2020-2029](#), Nov. 1, 2019
- Taft, J.D., and A.S. Becker-Dippmann, Pacific Northwest National Laboratory, [Grid Architecture](#), 2015
- California Public Utilities Commission, [Decision on Track 3 Policy Issues, Sub-Track 2](#) (Grid Modernization), March 22, 2018
- New Hampshire Public Utilities Commission, [Staff Recommendation on Grid Modernization](#), Jan. 31, 2019
- Minnesota Public Utilities Commission, [Staff Report on Grid Modernization](#), 2016

### **Distribution planning regulatory practices**

- U.S. Department of Energy's [Modern Distribution Grid](#) guides
- ICF, [Integrated Distribution Planning: Utility Practices in Hosting Capacity Analysis and Locational Value Assessment](#), prepared for U.S. Department of Energy, 2018

- Alan Cooke, Juliet Homer and Lisa Schwartz, [Distribution System Planning – State Examples by Topic](#), Pacific Northwest National Laboratory and Berkeley Lab, 2018
- Juliet Homer, Alan Cooke, Lisa Schwartz, Greg Leventis, Francisco Flores-Espino and Michael Coddington, [State Engagement in Electric Distribution Planning](#), Pacific Northwest National Laboratory, Berkeley Lab and National Renewable Energy Laboratory, 2017
- Tom Eckman, Lisa Schwartz and Greg Leventis, [Determining Utility System Value of Demand Flexibility From Grid-interactive Efficient Buildings](#), Berkeley Lab, 2020
- Berkeley Lab's [Future Electric Utility Regulation reports](#)
- Berkeley Lab's [research on time- and locational-sensitive value of DERs](#)
- Y. Tang, J.S. Homer, T.E. McDermott, M. Coddington, B. Sigrin and B. Mather, [Summary of Electric Distribution System Analyses with a Focus on DERs](#), by Pacific Northwest National Laboratory and National Renewable Energy Laboratory, 2017
- J.S. Homer, Y. Tang, J.D. Taft, D. Lew, D. Narang, M. Coddington, M. Ingram and A. Hoke. [Electric Distribution System Planning with DERs — Tools and Methods](#), 2020
- Smart Electric Power Alliance, [Integrated Distribution Planning: A Framework for the Future](#), 2020
- Forthcoming from Berkeley Lab — email [Lisa Schwartz](#) to request a draft:
  - T. Woolf, B. Havumaki, D. Bhandari, M. Whited and L. Schwartz. *Benefit-Cost Analysis for Utility-Facing Grid Modernization Investments: Trends, Challenges and Considerations*.
  - N. Mims Frick, S. Price, L. Schwartz et al. *Locational Value of Distributed Energy Resources*.

#### Impacts of DERs on net loads and approaches for actively managing load shapes

- Schwartz, L., M. Wei, W. Morrow, J. Deason, S. Schiller, G. Leventis, S. J. Smith, W. L. Leow, T. Levin, S. Plotkin, Y. Zhou and J. Teng. [Electricity End Uses, Energy Efficiency, and Distributed Energy Resources Baseline](#). 2017
- Darghouth, N., G. Barbose, and A. Mills. [Implications of Rate Design for the Customer-Economics of Behind-the-Meter Storage](#). 2019
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#### Demand flexibility as a utility system resource

- State and Local Energy Efficiency (SEE) Action Network. [Grid-Interactive Efficient Buildings: An Introduction for State and Local Governments](#). Prepared by L. Schwartz and G. Leventis, Berkeley Lab, 2020
- SEE Action Network. [Determining Utility System Value of Demand Flexibility From Grid-Interactive Efficient Buildings](#). Prepared by T. Eckman, L. Schwartz and G. Leventis, Berkeley Lab, 2020
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- Frick, N., T. Eckman and L. Schwartz, [Time-varying value of energy efficiency in Michigan](#), 2018
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- Frick, N., E. Wilson, et al., [End-Use Load Profiles of the U.S. Building Stock: Market Needs, Use Cases and Data Gaps; End-Use Load Profile Inventory](#), 2019
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- T. Woolf et al., *Benefit-Cost Analysis for Utility-Facing Grid Modernization Investments*, forthcoming

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- Schneider et al., [Preliminary Design Process for Networked Microgrids](#)
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- JB Twitchell, RS O'Neil and MT McDonnell, [Planning Considerations for Energy Storage in Resilience Applications](#)
- B Ward et al., [The Advanced Microgrid: Integration and Operability](#)
- PNNL energy storage site: <https://www.pnnl.gov/energy-storage>
- Sandia National Laboratories energy storage site: <https://www.sandia.gov/ess-ssl/>
- Storage resources from Berkeley Lab's Electricity Markets and Policy Department: <https://emp.lbl.gov/publications?f%5Bsearch%5D=storage>
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- Wiser, R.H., M. Bolinger et al. "[Wind Technologies Market Report: 2020 Briefing](#)." Berkeley Lab, August 2020
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### Planning for electric vehicles and strategies for managing charging

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- National Renewable Energy Laboratory electric vehicle load profiles: <https://afdc.energy.gov/evi-pro-lite>

- Medium-duty vehicle/heavy-duty vehicle load profiles: <https://www.pnnl.gov/news-media/influx-electric-vehicles-accelerates-need-grid-planning>
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- U.S. Department of Energy Alternative Fuels Data Center: <https://afdc.energy.gov/fuels/electricity.html>
- California Public Utilities Commission, Zero Emission Vehicles, <https://www.cpuc.ca.gov/zev/>